Temporal Shifts in Lithic Technology at the Clark Site (33Wa124): A Late Woodland Site in Southwest Ohio

A Senior Honors Thesis

Presented in Partial Fulfillment of the Requirements for Graduation

“with Honors Research Distinction in Anthropology” in the undergraduate

colleges of the Ohio State University

by

Wendy J. Church

The Ohio State University

February 26, 2012

Project Advisor: Professor Robert A. Cook, Department of Anthropology

Table of Contents

Figures:

Acknowledgements

It has been my privilege to train in archaeological research under the advisement of Dr. Robert Cook. I would like to thank Dr. Cook for not only his guidance in my research, but for the many frank discussions we’ve held over archaeological theory and method, ethics, best practices, and all that these perspectives entail in archaeological research. He has a gift for guidance while encouraging independent thought; only one of the many qualities which make him an outstanding undergraduate mentor.

I am grateful for having had access to laboratory facilities to conduct my research at the Ohio State University at Newark. I believe this facility is important to future growth at the regional level within the university system.

I wish to thank Dr. Richard Yerkes and Dr. Richard Shiels for their interest in my research, and for their service on the committee for my defense.

I would like to belatedly thank Joy Jones of Middletown, Ohio, for generously making her collections from a four year excavation project available for study. I wish she could see the fruits of her labor come to light.

I also thank the Undergraduate Research Office at the Ohio State University at Newark for funding radiocarbon dating for the Clark site, without which it would not have been possible to examine change over time; and for funding my conference travel for poster presentation of a portion of lithic research results for Clark at the 2011 Annual Midwest Archaeological Conference held in La Crosse, Wisconsin.

I also would like to thank Brad Lepper, Linda Pansing, and William Pickard of the Ohio History Center’s Archaeology Department for allowing me use of their lithic comparative collection, from which identification of chert sources at Clark were derived.

Finally, I would like to thank John, Rachael, and Mindy for their unending support, and for not throwing a book at the back of my head which is most visible during the many hours of research and data analysis that takes place at my home. I only wish my mom were here to share in the adventures.

Abstract

Late Woodland (ca. A.D. 700-1000) lithic assemblages often contain notched projectile points (Jack's Reef Corner Notched, Raccoon Notched) manufactured from exotic cherts, alongside triangular types (Levanna, Madison) fashioned from local materials. The co-occurrence of these types has been associated with a poorly understood Jack's Reef Horizon, distinct from typical Late Woodland Newtown assemblages.

Little is understood about the contemporaneity of these point types, and whether there were associated differences in lithic technology. The present study focuses on the Clark Site in southwestern Ohio, as it dates exclusively to the Late Woodland period and appears to represent one or few short occupations. Results of this study support a shift from use of exotic preforms in the manufacture of Jack's Reef and Raccoon Notched points to use of local cores to produce Levanna and other triangular forms.

Introduction

The Late Woodland in the Middle Ohio Valley (ca. A.D. 400-1000) has been described as a "good and gray culture" (Williams 1963: 297) and a "colorless interval" (Phillips 1970: 19) in the prehistory of Eastern North America, following the decline of elaborate Middle Woodland culture. The Late Woodland was actually a period of dynamic change in mobility patterns, technology, and subsistence, and has recently received more attention (e.g., Emerson et al. 2000), partly as researchers became focused on more fully examining processes associated with the end of the Middle Woodland dispersed settlement system and the emergence of late prehistoric village farmers. .

The Middle Ohio Valley Late Woodland

In the Middle Ohio Valley, the partitioning of the Late Woodland into sub-periods (early, initial) A.D. 400-700 and (late, terminal) A.D. 700-1000 provides a useful heuristic framework for examining cultural behavioral trends. However, a less temporally bounded division has also been proposed (Emerson et al. 2000), based on three major transitions: early, post-Middle Woodland demographic shifts and variability in settlement patterns; widespread use of bow and arrow technology ca A.D. 600-800; and, after A.D. 800-1000, increased maize dependency as an aspect of sedentism, leading to transformations in hierarchical sociopolitical systems.

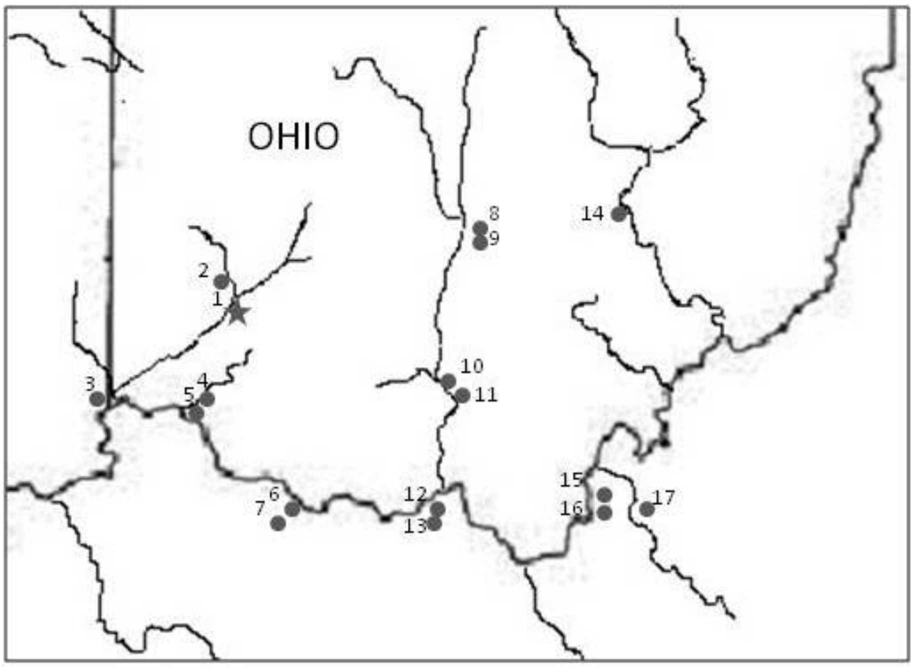
Early Late Woodland (ca A.D. 400-700) settlement patterns appear to have shifted, or cycled, from one of a dispersed mobile system to one of nucleation, with a return to use of smaller open sites during the terminal Late Woodland (ca A.D. 700-1000). Several studies suggest that smaller sites and task camps may be associated with larger sites (Church 1991;

Hughes and Niquette 1992; Niquette and Hughes 1991; Stevenson 1992; Trader 1992), but it is not particularly clear how all of these sites articulate with each other in time and space.

Large site layouts were variable throughout the early Late Woodland, with short to long term occupations and three possible site plans. Some sites appear to be arranged in redundant household clusters (Water Plant, Woods) with features in close proximity, while others contained large cooking features which were placed away from houses (Childers, Hansen), and perhaps some (Zencor, Lichliter, Pyles, Philo II) showing a circular or semi-circular arrangement had a plaza surrounded by houses enclosed by earthen walls and/or ditches or post structures.

Dancey (1992) suggests a "strategy of social storage" for the appearance of nucleated settlements early in the Late Woodland as a redistributive mechanism, prompted by defensive needs inferred by settlement enclosures. It has also been suggested that nucleation of dispersed, aggregating groups occurs when settling in one location reduces risks associated with food shortages and intra-group competition, also reducing labor costs associated with travel (Fuller 1981). Nucleation is ethnographically consistent with more intensive cultivation practices (Netting 1974), and, importantly, maize agriculture and attendant moves toward sedentism are well-known to occur in the Midwest at this time (Emerson et al. 2000). Archaeobotanical records show an increase in density and diversity of seed subsistence early, with maize increasing in importance after A.D. 800-1000 (Greenlee 2002; Gremillion 1996; Wymer 1992).

Clay and Creasman (1999) have questioned nucleated settlements, suggesting instead that this apparent patterning may be the result of multiple uses of such sites by small groups over time rather than aggregation by many at any one time. Most of these sites show multiple occupations across cultural periods and the association of enclosed structures and features with a specific period in time remains poorly understood. Additionally, while most researchers agree to an introduction of the bow and arrow in the region ca A.D. 600-800 based on pronounced changes in point morphology (Blitz 1988; Hall 1980; Morse and Morse 1983; Muller 1986; Seeman 1992), the role that the bow and arrow played in conflict interpreted in “defensive” enclosures is not clear.



1. Clark	5. Sandridge	9. Water Plant	13. Bentley	17. Parkline
2. Lichliter	6. Pyles	10. Ceplus	14. Philo II	
3. Haag	7. Gillespie	11. Harness-28	15. Childers	
4. Turpin	8. Zencor	12. Hansen	16. Woods	

Figure 1. Middle Ohio Valley Late Woodland sites mentioned in the text (map derived in part from Seeman and Dancey 2000).

Some researchers suggest that changes associated with the Late Woodland in the Midwest were a result of proto-Algonkian migration into the region between ca A.D. 200 and 700 (Blitz 1988; Custer 1990; Fiedel 1987; Luckenbach et al. 1987); perhaps associated with a group referred to as an "Intrusive Mound Complex", which has been connected to a brief phase dubbed “Jacks Reef Horizon” (Church1987; Seeman 1992). While very poorly understood, at a series of Early and Middle Woodland ceremonial mound sites such as Mound City, Willow Island, Harness, Frankfort, Hudson, Steitenberger, Heinish, Hebron, and Hilltop mounds, Jack's Reef Horizon materials and associated burials are a regular pattern. It has generally been thought that these peoples felt an ancestral link to the builders of these mounds, which were perhaps truly theirs, or, if they were a migrant group, these acts may have been to establish a connection to the past in order to validate their use of the area.

Although the link between Jack's Reef habitation sites and the intrusive burials has been elusive, Seeman (1992) identified two such sites: the Clark Site in Warren County, southwestern Ohio; and the Ceplus Site in Ross County, south central Ohio (see Figure 1). Interestingly, it was the similarities between these two sites and among other distinct regional Late Woodland assemblages that gave rise to the moniker "Jack's Reef Horizon" (Seeman and Dancey 2000).

A "Jack's Reef Horizon"

Jack's Reef Horizon sites have been described as distinct from early Late Woodland "Newtown" sites, as Newtown projectile point types conform to the Lowe Cluster expanded stemmed series defined by Justice (1987), and the former includes Jack's Reef Corner Notched and Raccoon Notched types (Justice 1987) manufactured from exotic cherts sourced to Harrison County, Coshocton County, Flint Ridge, and Carters Cave (Seeman 1992); contemporaneous in lithic assemblages with Levanna/Hamilton and Madison triangular types (Justice 1987). Jack's Reef Corner Notched and Raccoon Notched points are diagnostic of the previously mentioned Intrusive Mound Complex (Justice 1987; Seeman 1992), although the link between habitation sites and intrusive burials is not fully understood. Carskadden and Morton (1974; see also Seeman 1992) suggest that in the Middle Ohio Valley, Jack's Reef Corner Notched types precede Raccoon Notched within sites that yield at least three overlapping radiocarbon dates, or in stratigraphically sealed contexts where both are present, with Levanna/Hamilton continuing throughout the Late Prehistoric, although temporal brevity of these shifts (ca. A.D. 700-900) has made control of chronology difficult.

Seeman (1992) sees the presence of notched points from a northeast origin (Ritchie 1968) as an interruption in the sequence of an otherwise “smooth evolution” from traditional Adena and Hopewell types. Late Woodland Newtown lithic debris is consistent with primary manufacturing debris and use of locally available cherts, while Jack’s Reef Horizon site debris reflects use of exotic cherts consistent with maintenance and recycling efforts. In West Virginia, similar lithic assemblages have been recovered from Winfield Locks in association with a Woods Phase occupation, and a later Jack’s Reef component was identified at Parkline in Putnam County (Niquette and Hughes 1991; Niquette and Kerr 1993). At least four additional sites have yielded similar exotic debris: Sewage Treatment, Moorman, Burdge, and Snyder (Seeman 1992), although none of these sites have been fully investigated. Seeman (1992) recognizes a brief pattern ca. A.D. 700-900 fitting the definition of an archaeological “horizon” (Willey and Phillips 1958).

Ceramics at Jack’s Reef Horizon sites have been described as thicker and collared with “sloppy” cordmarking and variable smoothing of vessel surfaces in contrast to typical regional Newtown styles (Seeman 1992). Ceramic decoration of the neck and collar at Clark and Ceplus, dubbed “Clark ware and co-types” (Seeman 1992), is consistent with northeastern Jack’s Reef Corded Collared and Jack’s Reef Dentate Collar ceramic styles. Southeastern Ohio (Philo II) and West Virginia ceramics have been associated with an “intrusive” phase at Parkline with ties to the northeast (Niquette and Hughes 1991; Niquette and Kerr 1993). Ceramic temper at these sites is described as thicker and coarser compared to a Newtown trend toward thinner walls and finer grit tempering (Seeman 1992), conforming to Braun's (1987) pattern of thinner vessel walls for increased thermal capacity needed for slower cooking of seeds, although no formal functional and metric analysis has been presented for any Jack's Reef Horizon ceramic assemblage.

Jack's Reef Cluster point types (Justice 1987) have been reported elsewhere, where Lowe Cluster points (Justice 1987) and triangular point types are also present. In northern Kentucky, at Hansen, a brief Jack's Reef component associated with a later Late Woodland to Late Prehistoric occupation appears limited to an area in the northern portion of the site showing intense lithic activity dominated by Upper Mercer (25-40%) in the upper stratum (Ahler 1992). Cluster analysis for the Woods site, east of the Ohio River in West Virginia, shows a temporal shift from traditional stemmed points to triangular types ca. A.D. 800-1000; although one cluster was associated with a Jack's Reef biface found in feature context (Shott et al. 1992). The Haag site, in southeastern Indiana near the Great Miami/Ohio River confluence, yielded Lowe Cluster and Jack's Reef Cluster points as well as Madison triangular types where ceramics have been described as Newtown and possibly Parkline Cordmarked and Fort Ancient (Reidhead and Limp 1974).

Ceramics from several sites showing continuous occupation from the terminal Late Woodland into the Late Prehistoric in central and northern Kentucky and southwestern and southern Ohio have also been described as proto-Fort Ancient (ca. A.D. 1000) with a connection to the thicker wall trend characteristic of the Intrusive Mound Complex, contemporaneous with Jack's Reef Corner Notched points (Pollack and Henderson 2000).

The Clark Site

For my research problem, the Clark site is of special research interest as a terminal or late Late Woodland site (ca. A.D. 700-1000) in the region because it appears to be the result of one relatively short occupation, or multiple brief ones over a short period in time. The initial excavation of 2,500 square feet (Jones 1978, 1979) documented a series of buried midden deposits associated with several hearth areas on the edge of a former stream channel of the Great Miami River just south of Franklin, Ohio. Structural patterning was limited to a small line of post holes. A more recent excavation led by Dr. Robert Cook in the summer of 2009 focused on defining the site boundaries and excavating a hearth feature that contained *in situ* cooking stones and charred logs, presumably from its last use. The purpose of excavating another of the few remaining hearths was to procure flotation samples and secure context for dating the site.

The site is well-dated to the late Late Woodland period. Prior to the recent excavation, Cook submitted for AMS dating the only extant piece of wood charcoal from a midden deposit which produced a two-sigma calibrated range of A.D. 790-1030. An AMS radiocarbon date from a nutshell fragment from the recently excavated feature yielded a two-sigma calibrated date range of A.D. 660-780. Two additional dates obtained on deer bone from within the midden of each of two areas of interest, Area A and Area B (Figure 2), produced two-sigma calibrated ranges of A.D. 870-980 and A.D. 950-1020 (Figure 4).

This radiocarbon assay fits nicely with the expected suite of late Late Woodland projectile point types, indicating time depth at Clark, and making it possible to consider change over time. Analysis of spatial patterning of chipped stone artifacts at Clark was used to investigate whether Raccoon Notched, Jack's Reef Corner Notched, Levanna, and other triangular point types were associated with different methods of manufacture and raw material choices.

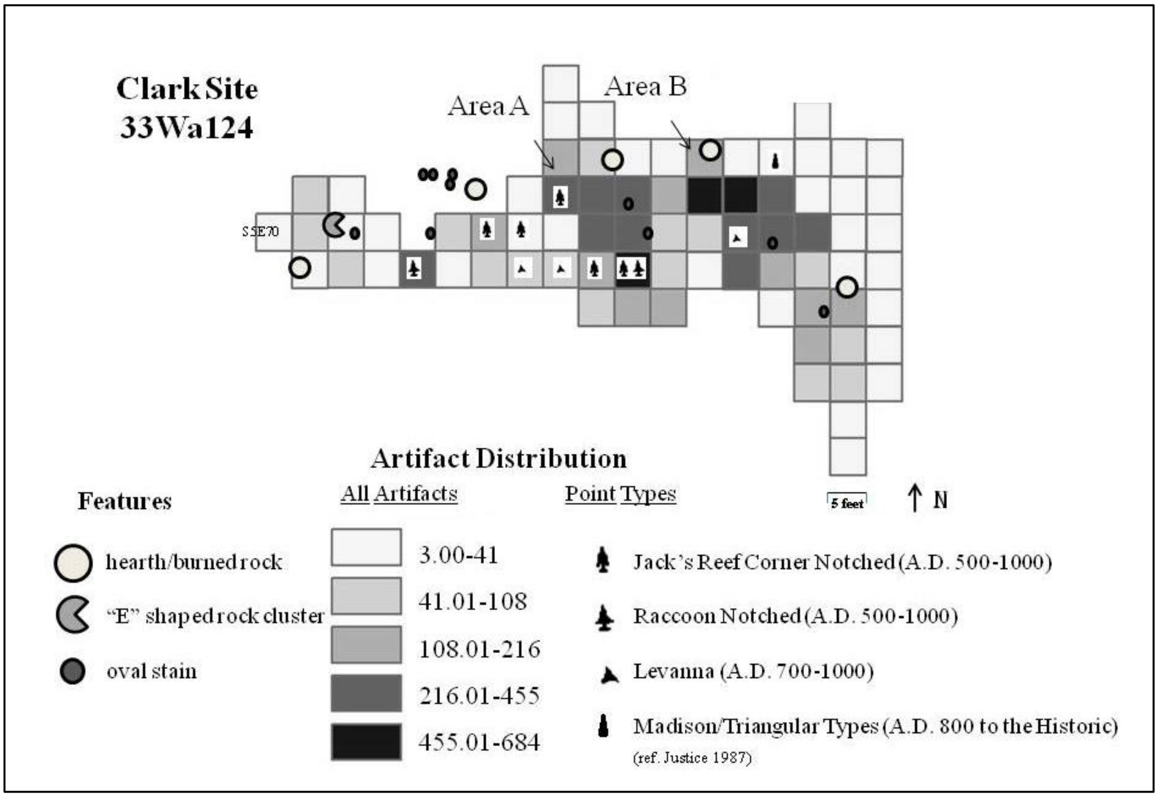


Figure 2. Clark site map showing location of high activity sample areas (A and B) and projectile point type distributions.

Location	Projectile Type	Sample	Laboratory Number	Conventional Radiocarbon Age	2 Sigma Calibrated Results	95% Probability
Area A	JR, RN, Levanna	deer bone	Beta-300573	1060 ± 30 BP	A.D. 900 to 920 (BP 1050 to 1030)	A.D. 950-1020 (BP 1000 to 930)
Area B	Levana/Madison	deer bone	Beta-300574	1130 ± 30 BP	A.D. 870 to 980 (BP 1080 to 960)	Unavailable

Figure 3. Most recent radiocarbon dates from Area A and Area B at Clark.

Figure 4a. Projectile points from Clark.

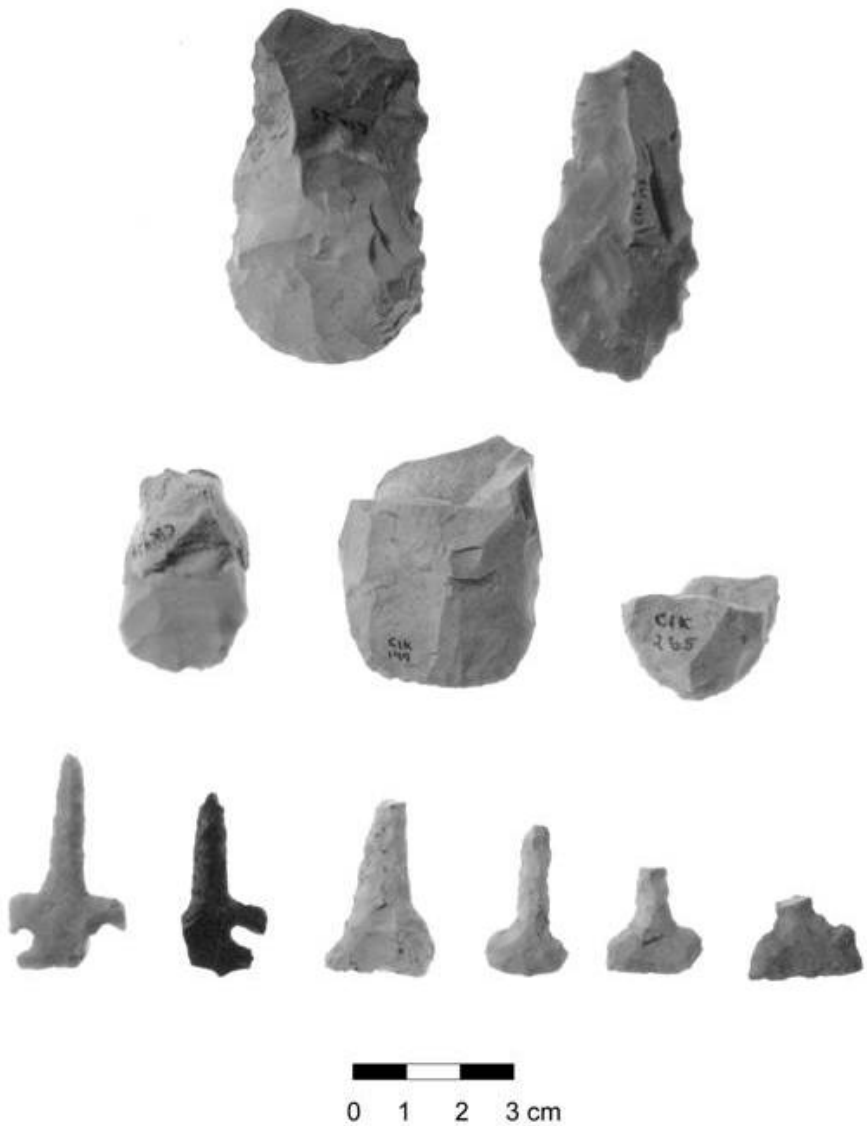


Figure 4b. Formal tools from Clark.

Figure 4c. Preforms from Clark.

For Clark, the artifact assemblage having context information is dominated by animal bone ([n=4,652] provenienced: 45%) and lithics ([n=4,177] provenienced 41%), plus surface collected cores, preforms, formal and informal tools, and points; with a substantial amount of pottery ([n=1,483] provenienced: 14%). The occurrence of chipped-stone tool types, cores and preforms is as follows, in descending order: cores (n=70 [38.5%]), preforms (n=36 [19.8%]), projectile points (n=31 [17%]), point/knife tips (n=23 [12.6%]), drills (n=13 [7.1%]), scrapers (n=7 [3.9%]), burins (n=2 [1.1%]). For the purpose of the present study, only debitage having context information was included, while analysis of all other lithic artifacts was expanded to surface collections to allow a sufficient sample size. The total distribution of all provenienced artifacts clearly indicates two main areas of activity, which have been designated Area A and Area B (Figure 4).

Analytical Research Methods

Metric analysis focused on projectile points, cores, preforms, formal and informal tools, and debitage (Andrefsky 2001, 2005; Odell 2003). General size characteristics were measured individually for projectile points, cores, preforms, and tools. Metric data for each of these groups included maximum length, maximum width, and maximum thickness. Weights were collected for each point, formal tool, core, and preform individually; through mass analysis for mass groups of informal tools (i.e. utilized flakes) and debitage. For projectile points, blade length, shoulder width, neck width, basal width, stem length, and depth of basal concavity were also included. Debitage analysis was limited to the two high-level activity sample areas: Area A and Area B. Maximum individual flake sizes were recorded in mass analysis in four size groups: <1 cm, 1-2 cm, 2-3 cm, 3-4 cm, 4-5 cm, >5 cm; and five flake typologies: complete, proximal, medial, distal, and shatter. Macroscopic analysis documented the presence of cortex, thermal alteration, and chert source for each lithic artifact.

Typology and standard metric measurements for projectile points were guided by Justice's (1987) *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States.* Jack's Reef Corner Notched points were identified by deep and distinct corner notching and thin shoulder barbs; Raccoon Notched by distinct notching of the sides and square ears. A morphological attribute of basal concavity and a flared basal edge arbitrarily identified Levanna points versus Madison points, which were identified by a relatively straight base. Completeness or fragment position and breakage patterns were documented. Spatial analysis of point distributions included plotting provenienced points within the site map.

Cores were grouped into multidirectional and unidirectional types. Descriptions of outstanding characteristics such as negative (and/or positive, in the case of detached cores) platform scar remnants (PSRs) from a point of applied force present, rotated cores (multidirectional cores [often bipolar] that have been turned for flake removal from different striking platforms), detached (cores exhibiting positive PSRs and flake removal from the ventral surface), exhausted (prominent lateral margins with degrees of concavity rendering further flake removal impossible), angular (sharp edges), and/or broken or shattered were also included in core analysis (Andrefsky 2001; Andrefsky 2005; Odell 2003).

Preform data was collected in a manner consistent with that of cores, with the additional categories of reduction type, stage of production, fragment position, and breakage patterns. Preform production stage was determined based on the following factors: early stage preforms contain relatively few and large flake scars; middle stage preforms contain significant edge work and thinning and relatively more and smaller flake scars, a trend that extends to late stage preforms that also contain the most regular morphology. Middle and later stage preforms are expected more so of exotic raw materials due to efforts to reduce transport costs and decrease the likelihood of failure in the finished products (Odell 2003).

Analytical approaches to informal flake tool and debitage data were the same for each artifact category; performed separately. Analysis began with size class percentages. Flake size is expected to decrease sequentially as intensity of core reduction and tool finishing and maintenance activity increases. Informal tool and debitage in each size class were categorized as complete flakes, broken flakes (proximal with point of applied force present), flake fragments (medial snapped or fractured terminations; distal with feathered or hinged termination), or shatter (sharp, angular "chunks" with no discernible ventral surface). Comparisons of debitage fragmentation in relation to cores can often be used to deduce reduction strategy. Medial and distal flakes were recorded separately to allow observation of termination characteristics: distal fragments showing feathered or hinged termination is an attribute which is consistent with a working definition of bifacial thinning flakes (Andrefsky 2005); distinguishable from medial fragments which are step fractured or snapped in a manner consistent with compression force used in bipolar reduction.

Higher percentages of cores and complete flakes in an assemblage indicate non-intensive core reduction (Sullivan and Rozen 1985), consistent with large flake removal for a detached core or informal tool industry; however, size class consideration must also be made to account for bifacial thinning flakes showing intact margins and little or no PSR, which overlap with nontool debitage in complete flake categories. Snapped or fractured flake fragments correlating to negative step fractures on cores can indicate bipolar reduction techniques. Higher percentages of shatter debris in a lithic assemblage indicate intensification of reduction efforts, and a greater percentage of flakes per core are indicative of tool manufacture as more flakes are removed in intentional reduction strategies (Sullivan and Rozen 1985). Experimental work shows that a lack of precision in hammerstone trajectory and core placement on an anvil surface produces greater amounts of shatter and “dust” debris during bipolar reduction (Jeske 1992).

Lack of control over flake morphology in bipolar technique significantly impacts the overall morphology of a lithic assemblage (Jeske 1992). Bipolar techniques used for recycling efforts in the reworking of broken or exhausted tools or bifaces, results in a greater quantity of “chunks” of bifacial debris. Flake debitage characteristics show no or diffuse bulbs of percussion, multiple “crushed” margins, and pronounced percussion rings caused by compression force. Finished tools may show asymmetry in thickness, as flake “blanks” removed from cores tend experimentally to be thicker on one side, compromised by step and hinge fractures which hamper thinning efforts, especially when using poorer quality cherts (Jeske 1992).

Thermal alteration is occasionally used to prepare materials for lithic reduction, but has also been argued to cause damage, rendering chert unusable (Pecora 2002). For this reason, thermal alteration was documented, but not included in the investigation. Cortex is known to vary from earlier stages of production (large flakes and cores, early stage preforms) to later stages of production (small flakes, late stage preforms, finished tools), but has also been the subject of controversy when used to determine reduction stages (see Amick and Mauldin 1989); for this reason cortex was likewise documented but not used in investigations into reduction methods. Chert sources were macroscopically identified using the Ohio Historical Society's Archaeology Department’s lithic comparative collection.

Lithic Analysis

Cherts in the Clark site assemblage have been identified by the author as Harrison County, Upper Mercer, and local/unidentified pebble cherts. The following descriptions of Harrison County and Upper Mercer cherts are based on DeRegnacourt and Georgiady (1998), and Stout and Schoenlaub (1945).

Raw Material Sources

Harrison County chert, also known as Wyandotte, Indiana Hornstone, or Kentucky Blue, was highly utilized continuously from the Paleo-Indian through the Historic; peaking during the Terminal Late Archaic through the Middle Woodland, and phasing out during the Late Woodland to the Prehistoric, when it became localized to its source in southern Indiana. Geographic distribution indicates it was widely traded, occurring in lithic assemblages from central to southern Indiana and north central Kentucky; southward along the Mississippi Valley and Tennessee River into Tennessee, Alabama, and Georgia; west into Kansas and Missouri; and northward into western New York, Chesapeake Bay, and southern Ontario. Large “cannonball” nodules occur at the source, which outcrops into western Crawford County and across the Ohio River into northern Kentucky (DeRegnaucort and Georgiady 1998).

Harrison County chert is distinctly recognizable by its short range of medium to dark grey colors; its homogeneity marked by occasional banding or a “bulls eye effect” which often figures prominently in blade and point manufacture as a decorative feature (DeRegnaucort and Georgiady 1998). The physical appearance of this chert is waxy to porcelanous, although heavier concentrations of quartz, based on a comparative observation, visibly matte the surface and add a “glittery” effect. The Harrison County material observed in the lithic assemblage at Clark consists almost exclusively of the former. The mineral properties of Harrison County chert include cryptocrystalline quartz, chalcedonic quartz, dolomite, calcite, pyrite, fluorite, and anthraxolite (DeRegnaucort and Georgiady 1998). Only one Harrison County specimen from the Clark site showed a break occurrence due to material imperfection: a middle stage preform which was snapped at a cavity showing secondary mineral inclusion.

Upper Mercer chert, sourced to east central Ohio, was less represented in the lithic assemblage at Clark. Also known as Coshocton County, Coshocton County Black, and Coshocton County Lightning Bolt, this source, which outcrops in Coshocton, Muskingum, and Perry counties, was rarely utilized until the Early Archaic; its use completely ending during the Woodland and Prehistoric (DeRegnaucort and Georgiady 1998). Geographic distribution is most dense within 50 miles of outcroppings, with lesser concentrations extending west into eastern Indiana, east into Pennsylvania, and south into northern Kentucky. Characteristic color combinations and markings of white to off-white; striped, banded, or mottled shades of grey; mottled white on black, black; and black with bluish veins ("lightning bolts" of quartz) have led to the named varieties of Upper Mercer Grey, Upper Mercer Bird Dropping, Upper Mercer Black and White, and Upper Mercer Nellie (DeRegnaucort and Georgiady 1998).

The physical appearance of Upper Mercer cherts is waxy to porcelanous; however, Stout and Schoenlaub (1945) identified a fine grain surface structure under a 100 diameter magnification, with a larger proportion of isotropic matter than generally occurs in structurally sound cherts, accompanied by crystalline with quartz inclusions lining microscopic cracks and cavities. Overall mineral composition includes chalcedonic-quartz, hematite, limonite, carbon, organics (with some fossilization), clays, ankerite, pyrite, detrital quartz (small quartz fragments bound together from larger broken quartz fragments), and dolomite (DeRegnaucort and Georgiady 1998).

Unidentified lithic materials at the Clark site, although not positively sourced, are of lesser quality and most likely locally available pebble cherts. Colors include shades of white or grey to tan, yellow, or cream colors with pink inclusions or banding. Surface appearances are dull, grainy, chalky and porous, and quartz filled cavities are common visible inclusions. Generally, local pebble cherts are characteristically more siliceous and fossiliferous.

Projectile Points

The majority of projectile points in the lithic assemblage for Clark were Jack's Reef Corner Notched (36% [n=11]) and Raccoon Notched (26% [n=8]), with lesser amounts of Levanna (19% [n=6]) and Madison (19% [n=6]) point styles (Figure 4; Appendix A). No Jack's Reef Corner Notched points were complete; most were proximal fragments (n=9 [81.8%]) with two medial portions (18.2%). Two Raccoon Notched points were complete (25%) and six (75%) were proximal fragments. Three (50%) of the Levanna points were complete and three (50%) were proximal fragments. One (16.7%) Madison point was complete, four (66.7%) were proximal fragments, and one (16.7%) was a medial fragment.

Jack's Reef Corner Notched points were nearly equally made from Harrison County (n=4 [36.4%]), Upper Mercer (n=3 [27.3%]), and local/unidentified cherts (n=4 [36.4%]). Raccoon Notched points were manufactured from similar proportions: Harrison County (n=2), Upper Mercer (n=3), local/unidentified (n=3). Levanna (n=6) and Madison (n=6) points were all manufactured from local/unidentified cherts. Correspondence analysis shows the clear shift in usage from exotic to local sources (Table A3).

At Clark, statistical analysis on projectile point metrics shows a larger range for maximum thickness on local/unidentified triangular types ([n=12] 2.33) versus exotic notched types ([n=13] 1.8), with overlap within and between chert sources and types, and no gross differences in mean or median thickness; although a majority of notched points fall in the 4-5 cm range versus triangular points, the majority of which measure evenly between 3-4 cm and 4-5 cm size classes (see also Tables A1 and A4). Small sample sizes for complete points prevented further analysis concerning maximum length and relative thickness. Results are consistent with general descriptions of smaller, thinner triangular points.

Spatial analysis shows provenienced Jack's Reef Corner Notched points were all located in the western portion of the site, mostly in or near Area A. Two Levanna points also occur near Area A but are a distinct minority. The generally later triangular forms (Levanna and Madison) were the only types associated with Area B (see Figure 2). This pattern sets up temporal contexts for examining shifts in technology and raw material usage within the site.

Formal and Informal Tools

Formal tool types at Clark include 13 drills, two burins, seven scrapers, and point/knife tips and edges. Drills show some morphological variation, including T-shaped (n=5 [38.5%]), corner notched (n=2 [15.4%]), triangular (n=2 [15.4%]), along with tips and other fragments (n=4 [30.8%]); (see Table B1). The corner notched drills appear to be recycled from Jack's Reef Corner Notched projectile points: one was sourced to Harrison County and the other was local/unidentified**.** Three (23.1%) of the thirteen drills showed potlidding and were manufactured from Harrison County chert. One complete unifacial triangular drill was made from Upper Mercer chert and contained a basal concavity. The two burins were manufactured from local/unidentified cherts. Of the seven ovate scrapers, four (58%) are complete and three (42%) are distal fragments. Three (42%) are Harrison County chert and four (58%) are local/unidentified cherts. Point/knife fragments included tips (n=10), bases (n=5), and medial fragments (n=8). Raw materials for point/knife fragments included five (21.7%) Harrison

County, ten (43.5%) Upper Mercer, and eight (34.8%) local/unidentified cherts. A chisel sourced to Harrison County appears to be recycled from a broken projectile point. None of these formal tools had cortex.

Formal tool breakdown for each sample area is as follows: Area A (n=1) had only one non-diagnostic drill tip fragment of local/unidentified material exhibiting a diagonal snap; Area B (n=3) had one complete T-shaped drill of local/unidentified chert, an additional T-shaped drill tip made from Upper Mercer chert with a transverse snap break pattern, and a non-diagnostic tip fragment made from Upper Mercer chert which exhibited a diagonal snap. There were no other formal tool types provenienced within the sample areas.

A total of 304 informal tools, i.e., utilized flakes were identified at Clark. Of the total 103 utilized flakes provenienced within the sample areas at Clark, 61 (59%) were complete flakes; although proximal ([n=14] 13.5%), medial ([n=13] 10%), and distal ([n=15] 14.5%) fragments invariably were represented as well (Table D1).Utilized flakes accounted for six percent of debitage for Area A (n=32) and Area B (n=71). Informal tools consist mostly of flakes falling within a 1-3cm size class (82% [n=84]), and all informal flake tools measuring >3cm (100% [n=19]) were identified as complete flake types in both areas. In Area A, Harrison County (69% [n= 22]) was most common, followed by Upper Mercer (13% [n=4]), and local/unidentified cherts (18% [n=6]). In Area B, the situation is similar: Harrison County (56% [n= 40]), Upper Mercer (20% [n=14]), and local/unidentified cherts (24% [n=17]). Of the 10 flakes exhibiting evidence of heat treatment, eight (80%) were Harrison County and two (20%) were Upper Mercer; while none of the local/unidentified cherts showed evidence of heating. More than half (58% [n=23]) of the Area B Harrison County utilized flakes came from within two units (N5E130 and N5E135) directly associated with one hearth feature.

Cores and Preforms

Two thirds of the 70 cores from Clark (Figure 3; Table C1) were local/unidentified chert sources (66% [n=46]), with relatively even proportions of Harrison County (19% [n=13]) and Upper Mercer (16% [n=11]) cherts. Nearly two-thirds (n=45 [64.3%]) of the cores were multidirectional, with the remainder (n=25 [35.7%]) being unidirectional. Twice the percentage of unidirectional cores (8%) than multidirectional (4%) were thermally altered, but more even proportions of unidirectional cores (56%) and multidirectional cores (62%) contained cortex. Multidirectional cores were mostly local/unidentified (68.9%) with lower occurrences of Upper Mercer (17.8%) and Harrison County (13.3%) cherts. Unidirectional cores were also mostly local/unidentified (60%) but with a sizeable proportion of Harrison County chert (28%) and similarly low amounts of Upper Mercer (12%).

Detached cores (n=5) make up 7% of all cores; rotated ([n=5] 7%); broken or shattered ([n=8] 11%) and exhausted ([n=12] 17%). Two of the detached cores were from Harrison County (40%); the other three were local/unidentified (60%). Of the five rotated cores, one was from Harrison County (20%) and the other four were local/unidentified (80%). Of the eight broken or shattered cores, three were Harrison County (37.5%), two were Upper Mercer (25%), and three were local/unidentified (37.5%). The source distribution of exhausted cores was fairly even: Harrison County ([n=4] 33%), Upper Mercer ([n=3]25%), and local/unidentified ([n=5] 42%).

Core analysis for sample areas A (n=1) and B (n=9) shows a difference in both activity level and raw material usage. The only core associated with Area A was an Upper Mercer multidirectional core showing cortex and multiple angular shatter breaks. This core fell under a median weight range at 28.3 grams. Local/unidentified chert sources positively correlate to core reduction in Area B: only 1 core was Harrison County: it had no cortex, was exhausted, showed edge wear, and weighed just 1.28 grams. Two additional cores from Area B, sourced as local/unidentified cherts, also showed edge wear: one was non-cortical, rotated, angular, and exhausted, weighing 3.95 grams; and another was cortical, with three rounded and one broken edge; showing heavy batter all around, and weighing 44.05 grams. That three of the nine (1/3) cores found in Area B were used as tools indicates a high level of core tool use or reuse (see also Andrefsky 2005). The remaining 6 local/unidentified cores ranged in weight from 1.78 grams to 52.37 grams, for a total weight of 107.8 grams. The core per debitage ratio for Area A is 1/541, while Area B showed a proportionally higher percentage of cores and a higher ratio of cores per debitage (9/1099, or, 1/122). The data strongly supports more core reduction activity in Area B.

None of the cores from either area showed thermal alteration. While the one Upper Mercer core from Area A showed cortex, of the nine cores in Area B, four showed cortex (nearly half). No Upper Mercer cores were associated with Area B.

Of the 36 total preforms (Figure 3; Table C2) most were Harrison County (47% [n=17]), and local/unidentified cherts (36% [n=13]), with a smaller proportion of Upper Mercer (17% [n=6]). The breakdown of production stages for the site is as follows: four early (11.1%), twenty-one middle (58.3%), and eleven late (30.6%). Raw material comparisons for the three preform stages reveal that early and late stages are dominated by local/unidentified cherts (67%), whereas middle stage is dominated by Harrison County chert (67%). In combination with the core data, this pattern supports the inference that early and late stages are represented by local cherts as they were at hand, and they failed more often at the end stages as they were of generally poorer quality than the exotic materials. That Harrison County chert was mostly present as middle stage preforms indicates that this raw material was brought to the site more often this way than as cores.

All lateral, crescent, and impact breaks occur on middle stage preforms. Transverse breaks are very common on late stage preforms (n=7 [63.6%]) but also occur on middle stage preforms (n=6 [28.6%]). The majority of bifacial preforms were broken and discarded at various stages of manufacture, with the exception of three complete late stage and one complete middle stage preform. These preform breakage patterns support the general understanding from experimental studies that production failures occur more often during earlier stages of manufacture.

Area A and B preforms, with one exception, were broken. Preforms in the two sample areas were all bifacial, and the only two showing heat alteration were of Harrison County material; one in each area. In Area A, most (75% [n=3]) of the preforms were Harrison County with one (25%) local/unidentified chert. All Harrison County were middle stage, one had cortex, and one showed thermal alteration. The local preform was early stage and had cortex. In Area B, preforms were evenly divided among Harrison County (25% [n=1]) and local/unidentified cherts (25% [n=1] late stage); and Upper Mercer (50% [n=2] both middle stage).

Statistical analysis of metric data on maximum lengths for all cores and intact preforms shows similarity in overall morphology: the mean and median length of cores are 39.30 mm and 37.79 mm, respectively; 43.78 mm and 39.43 mm for preforms; i.e. similar sizes indicate similar starting points for both cores and preforms**.**

Core and preform data for Areas A and B support non-intensive core reduction for Harrison County cherts occurred elsewhere, prior to the transport of preforms. A higher proportion of local/unidentified cores over preforms suggests continuity of tool manufacture stages from core reduction to tool finishing took place in Area B, and the level of overall lithic activity was significantly higher in Area B (9 cores and 4 preforms) than Area A (1 core and 4 preforms). Correspondence analysis shows statistical significance at .176 (Table C3). A high proportion of cores used as tools in Area B suggest a core tool industry may have been important during a later occupation of the site.

Debitage

Debitage (n=3995) analysis was limited to Areas A and B (see Figure 2). Area A had half the amount of debitage (n=541) as Area B (n=1,099), despite being of similar size; however, reduction methods and tool production determined by flake type and size class frequencies indicate no gross difference in manufacture method. Flakes within the 1-2cm size class range comprise more than fifty percent of the total for each area, with 0-1cm flakes occurring at approximately thirty percent for each area, 2-3cm flakes occurring at approximately ten percent for each area, and larger size classes occurring less frequently, at or below two percent. The results of size class analysis indicate primarily tool finishing and maintenance activities in both sample areas.

The results of flake debitage type frequencies for each area are consistent with little non-intensive core reduction and mostly tool manufacture. Flake fragments make up roughly half the debitage assemblage for each area, but Area B has considerably more fragments ([n=600] 55%) than Area A ([n=235] 44%) and Area A has consistently higher frequencies of complete and broken flakes and shatter. Separate analyses of medial and distal flake fragments shows a higher percentage of medial fragments over distal fragments in both areas, with no gross difference when cross referencing size class (Table D3) or material source (Table D4). Higher percentages of medial flakes making up the flake fragment category are consistent with negative fracture scars observed on cores to support mainly bipolar reduction techniques in each area (Area A [n=144] 27% and Area B [n=428] 39%), while distal hinged or feathered flakes make up only 17% (n=91) of Area A and 16% (n=172) of Area B.

The frequency of Harrison County chert is greater in Area A (43%) than in Area B (30%), which is consistent with the preform data. Harrison County material is heavily concentrated in the two units in Area B ([N5E130 and N5E135] 60%), which are directly associated with the above mentioned hearth feature. In contrast, the distribution of Harrison County chert in Area A is ubiquitous and relatively even. Evidence of thermal alteration of debitage also occurs more frequently in Area A (16%) than in Area B (10%). Cortical flakes account for a small percentage of overall debitage but are slightly more common in Area A (11%) than in Area B (7%). The presence of cortex does decrease as flake size decreases, as is commonly expected. Of interest, albeit based on a small sample of flakes, is the complete absence of Harrison County materials in the larger size classes for Area B (n=18), while four of thirteen (31%) flakes under these size classes in Area A were of thermally altered Harrison County chert.

Upper Mercer debitage frequencies were moderate and even for Area A ([n=30] 6%) and Area B ([n=63] 6%), while local/unidentified materials made up half of Area A ([n=276] 51%) and approximately two-thirds of Area B ([n=705] 64%). Consistent underrepresentation of Upper Mercer material among all lithic artifact types creates an interesting contradiction to descriptions of other known Jack's Reef Horizon assemblages, while a high proportion of Harrison County suggests strong ties to the source in Indiana.

Discussion

When energetic efficiency is defined as time and energy considered in selection and use of raw materials (Jeske 1989, 1992), the economical consideration of using readily available but poorer quality materials must weigh overall costs and benefits: manufacture uses less time, but results in higher failure rates and much more waste in the form of unusable debris. Jeske (1992) attributes the efficiency of using locally available but lower quality raw materials to bipolar reduction, citing a variety of reasons for the technique, including an inability to obtain large cobbles or good quality cobles, and a common occurrence of internal "frost" fracture patterns caused by material impurities. Experimental studies show bipolar reduction allows a greater applied force necessary for the removal of fossiliferous or otherwise flawed materials, while also allowing somewhat greater control of unpredictable flaking patterns (Jeske 1992).A reduction in labor costs associated with travel is a trade-off for manufacturing difficulties associated with use of local, poorer quality cherts in the manufacture of projectile points (Jeske 1992). Perhaps manufacture of simpler, triangular points further reduced the energy invested in projectile point production.

In the Middle Ohio Valley, Late Woodland lithic assemblages are characterized by predominately local materials coinciding with the introduction of bow and arrow technology ca A.D. 600-800; with the exception of exotic and recycled tools associated with a poorly understood Jack's Reef Horizon, characterized in literature by predominantly exotic cherts. An initial increase in agricultural activity in the region ca. A.D.800-1000 would be expected to induce a reorganization of labor, as energy associated with activities such as travel to obtain raw materials was diverted to accommodate new demands on time and energy associated with other aspects of subsistence, i.e., attendant food production. Economizing strategies reflected in shifts in lithic technology at Clark and a possible new tool focus are strongly suggestive of an adaptive response to energy budget stress on local populations in the Middle Ohio Valley during the latter half of the Late Woodland; parallel to increased agricultural activities in the region.

Conclusion

The higher occurrence of exotic preforms and local cores at Clark supports the conclusion that initial reduction of exotic cherts happened elsewhere, likely near the source. Area A was associated with more end stage reduction of exotic preforms and tool re-sharpening and reuse, whereas Area B was mainly associated with local core reduction and tool finishing, and core tool use/reuse. The larger local cores are similar in size to earlier stage exotic preforms; hence, size of debitage is similar despite core versus preform starting points. Area A was associated with more use of exotic materials, with a higher percentage of shatter indicating bipolar techniques for reworking tools (Sullivan and Rozen 1985). On local/unidentified cores, a majority of flake scars show step fracture consistent with bipolar reduction methods also favored for production using local/unidentified materials (Odell 2003).

The purpose of the present study was to examine a single component site showing clear spatial patterning to determine whether the occurrence of notched and triangular points was contemporaneous, or if this trend reflects a temporal shift in lithic technology; and whether there were any associated differences in raw material selection. The Clark site captures an important moment of change in the Late Woodland period in the Middle Ohio Valley. Earlier use of the site was associated with Jack's Reef Corner Notched projectile points and contained more exotic raw materials that most often made their way to the site as already reduced preforms (middle stage or later). Later stages of reduction and recycling of points to make scrapers and drills was more common in these initial uses of the site. This pattern of resource procurement is consistent with the general description of the period as a time of relatively high mobility associated with the introduction of the bow-and-arrow. However, consideration of the later uses of the site revealed an interesting development, one that had much greater use of local raw materials and bipolar reduction, associated with the production of the late prehistoric Levanna and Madison projectile points. This pattern effectively remains unchanged through the remainder of prehistory in the region.

This finding stresses the need to more closely examine small "single component" Late Woodland sites such as Clark, as these hold important lessons to help us more fully understand the transition to sedentism which clearly occurs in the late prehistoric period (post-A.D. 1000). Further comparative research is needed to determine if this pattern is repeated among other regional Jack’s Reef Horizon lithic assemblages, and to determine the significance of shifts in late Late Woodland (A.D. 700-1000) lithic technology and how these shifts fit into a broader pattern of changes in subsistence and settlement.

References

Ahler, Steven R.

1992 The Hansen Site (15Gp14): A Middle/Late Woodland Site Near the Confluence of the Ohio and Scioto Rivers. In *Cultural Variability in Context*: *Woodland Settlements of the Mid-Ohio Valley*, edited by Mark F. Seeman, pp. 30-40. Midcontinental Journal of Archaeology Special Paper No. 7. Kent State University.

Amick, D. S., and R. P. Mauldin

1989 Comments on Sullivan and Rozen's "Debitage Analysis and Archaeological Interpretation." American Antiquity 54:166-168.

Andrefsky, William, Jr. (editor)

2001 *Lithic Debitage: Context, Form, Meaning*. The University of Utah Press, Salt Lake City.

Andrefsky, William, Jr.

2005 *Lithics: Macroscopic Approaches to Analysis, Second Edition*. New York: Cambridge University Press.

Blitz, John H.

1988 Adoption of the Bow in Prehistoric North America. *North American Archaeologist* 9:123-145.

Carskadden and Morton

1974 Late Woodland Projectile Points. *Ohio Archaeologist.* 24: 18-22.

Church, Flora

1991 The Hunter I Site: Mitigation of a Multicomponent Late Woodland Site in Blue Rock Township, Muskingum County, Ohio. Archaeological Services Consultants, Columbus, Ohio.

Clay, R. Berle, and Steven D. Creasman

1999 Middle Ohio Valley Nucleated Settlements: “Where’s the Beef?” *West Virginia Archeologist* 51:1-10.

Custer, J. F.

1990 The Woodland I-Woodland II Transition in the Delmarva Peninsula. *North American Archaeologist* 11:273-287.

Dancey, William S.

1992 Village Origins in Central Ohio: The Results and Implications of Recent Middle and Late Woodland Research. In *Cultural Variability in Context*: *Woodland Settlements of the Mid-Ohio Valley*, edited by Mark F. Seeman, pp. 24–29. Midcontinental Journal of Archaeology Special Paper No. 7. Kent State University.

DeRegnaucourt, Tony, and J. Georgiady

1998 *Prehistoric Chert Types of the Midwest.* Upper Miami Valley Archaeological Research Museum.

Emerson, Thomas E., Dale L. McElrath, and Andrew C. Fortier

2000 Social Evolution or Social Response? A Fresh Look at the "Good Gray Cultures" after Four Decades of Midwest Research. In *Late Woodland Societies: Tradition and Transformation across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 3-36. University of Nebraska Press, Lincoln.

Fiedel, Stuart J.

1987 Algonkian Origins: A Problem in Archaeological-Linguistic Correlation. *Archaeology of Eastern North America* 15:1-11.

Fuller, John

1981 The Development of Sedentary Village Communities in Northern West Virginia: The Test of a Model. In *Plowzone Archaeology: Contributions to Theory and Technique*, edited by M. O'Brien and D. Lewarch, pp. 187-214. Vanderbilt University, Publications in Anthropology 27. Nashville.

Greenlee, Diana M.

2002 Accounting for Subsistence Variation Among Maize Farmers in Ohio Valley Prehistory. Unpublished PhD. Dissertation, Department of Anthropology, University of Washington.

Gremillion, Kristen J.

1996 Diffusion and Adoption of Crops in Evolutionary Perspective. *Journal of Anthropological Archaeology* 15: 183–204.

Hall, Robert L.

1980 An Interpretation of the Two-Climax Model of Illinois Prehistory. In *Early Native Americans*, edited by David L. Browman, pp. 401-462. Mouton, The Hague.

Hughes, M. A. and Charles M. Niquette (editors)

1992 *The Winfield Locks Site: A Phase III Excavation in the Lower Kanawha Valley, Putnam County, West Virginia*. Contract Publication Series 92-81. Cultural Resource Analysts, Inc., Lexington, Kentucky.

Jeske, Robert J.

1989 Economies in Lithic Use Strategies Among Prehistoric Hunter-Gatherers. In *Time, Energy, and Stone Tools*, edited by Robin Torrence, pp. 34-45. Cambridge University Press.

1992 Energetic Efficiency and Lithic Technology: An Upper Mississippian Example. *American Antiquity* 57:467-481.

Jones, Joy
1978 A Preliminary Report on a Puzzling Single Component Woodland Site in Southwestern Ohio. *Ohio Archaeologist* 28:17-20.

Jones, Joy
1979 Clark Site Ware: Southwestern Ohio Pottery Related to Central Indiana Late Woodland. *Ohio Archaeologist* 29:20-24.

Justice, Noel D.
1987 *Stone Age Spears and Arrow Points of the Midcontinental and Eastern United States*. Bloomington: Indiana University Press.

Luckenbach, A.H., W.E. Clark, and R.S. Levy
1987 Rethinking Cultural Stability in Eastern North American Prehistory: Linguistic Evidence from Eastern Algonkian. *Journal of Middle Atlantic Archaeology* 3:1-33.

Morse, Dan F. and Phyllis A. Morse
1983 *Archaeology of the Central Mississippi Valley.* Academic Press, New York.

Muller, Jon
1986 *Archaeology of the Lower Ohio River Valley.* Academic Press, New York.

Netting, Robert M.
1974 Agrarian Ecology. *Annual Review of Anthropology* 3:21-56.

Niquette, Charles M., and Myra A. Hughes (editors)
1991 Late Woodland Archaeology at the Parkline Site (46PU99), Putnam County, West Virginia. Cultural Resource Analysts, Inc., Contract Publication Series 90-93, Lexington.

Niquette, Charles M., and Jonathan P. Kerr
1993 Late Woodland Archaeology at the Parkline Site. Putnam County, West Virginia. *West Virginia Archeologist* 45:43-59.

Odell, George H.
2003 *Lithic Analysis*. New York: Springer Science and Business Media.

Pecora, Albert M.
2002 The Organization of Chipped-stone Tool Manufacture and the Formation of Lithic Assemblages. Unpublished Ph.D. Dissertation. The Ohio State University.

Phillips, Philip
1970 *Archaeological Survey of the Lower Yazoo Basin, Mississippi*, 1949–1955. Papers of the Peabody Museum of American Archaeology and Ethnology, Volume 60. Harvard University, Cambridge.

Pollack, David, and A. Gwynn Henderson
2000 Late Woodland Cultures in Kentucky. In *Late Woodland Societies: Tradition and Transformation across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 613-641. University of Nebraska Press, Lincoln.

Reidhead, Van A., and W. Frederick Limp
1974 The Haag Site (12D19): A Preliminary Report. *Indiana Historical Society, Archaeological Bulletin* 1:4-18.

Seeman, Mark F.
1992 Village Origins in Central Ohio: The Bow and Arrow, The Intrusive Mound Complex, and a Late Woodland Jack's Reef Horizon in the Mid-Ohio Valley in *Cultural Variability in Context: Woodland Settlements of the Mid-Ohio Valley*, edited by Mark F. Seeman, pp.41-51. Kent: Kent State University Press.

Seeman, Mark F., and William S. Dancey
2000 The Late Woodland Period in Southern Ohio: Basic Issues and Prospects. In *Late Woodland Societies: Tradition and Transformation across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 583-611. University of Nebraska Press, Lincoln.

Shott, Michael J., and Richard W. Jefferies
1992 Late Woodland Economy and Settlement in the Mid-Ohio Valley: Recent Results from the Childers/Woods project. In *Cultural Variability in Context: Woodland settlements of the Mid-Ohio Valley*, edited by Mark F. Seeman, pp. 52-64. Midcontinental Journal of Archaeology Special Paper No. 7. Kent, OH: Kent State University.

Stevenson, C. M.
1992 *Archaeological Mitigation of 46MR96: A Middle Woodland Habitation, Marshall County, West Virginia.* Archaeological Services Consultants, Columbus, Ohio.

Stout, Wilbur, and Schoenlaub, R.A.
1945 The Occurrence of Flint in Ohio. Columbus. Ohio Department of Natural Resources.

Sullivan, Alan P., III, and Kenneth C. Rozen
1985 Debitage Analysis and Archaeological Interpretation. *American Antiquity* 50:755-799.

Trader, Pat D.
1992 Archaeological Investigations at the Ronald Watson Site (15BE249): A Late Woodland Site in Boone County, Kentucky. Paper presented at the Ninth Annual Kentucky Heritage Council Archaeological Conference, Murray, Kentucky.

Willey, Gordon R., and Philip Phillips
1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago.

Williams, Steven

1963 The Eastern United States. In *Early Indian Farmers and Village Communities*, edited by William G. Haag, pp. 267–325. National Park Service, Washington.

Wymer, Dee Ann
1992 Trends and Disparities: The Woodland Paleoethnobotanical Record of the Mid-Ohio Valley. In *Cultural Variability in Context*: *Woodland Settlements of the Mid-Ohio Valley*, edited by Mark F. Seeman, pp. 65–76. Midcontinental Journal of Archaeology Special Paper No. 7. Kent State University, Kent.

Index of Appendices

Appendix A: Projectile Points

Table A1: Projectile Point Metrics (in millimeters)   *no data

ID#	Point Type	Position	Source	ml	mw	mt	bl	sw	nw	bw	sl	dc
5	Jack's Reef CN	proximal	l/u	*	*	5.13	*	23.97	12.11	*	11.43	absent
82	Jack's Reef CN	proximal	l/u	*	24.64	3.96	*	23.55	13.73	21.29	8.81	absent
89	Jack's Reef CN	proximal	HC	*	22.16	4.1	*	22.16	13.05	20.33	8.36	absent
123	Jack's Reef CN	proximal	HC	*	27.63	4.9	*	27.63	15.76	24.35	9.36	absent
134	Jack's Reef CN	proximal	HC	*	28.31	4.26	*	28.31	13.42	20.94	11.42	absent
194	Jack's Reef CN	proximal	l/u	*	*	4.05	*	*	12.62	*	7.21	absent
176	Jack's Reef CN	proximal	UM	*	*	4.35	*	*	9.84	*	9.44	absent
206	Jack's Reef CN	medial	l/u	*	22.62	4.52	*	*	*	*	*	absent
254	Jack's Reef CN	proximal	UM	*	*	4.26	*	*	10.4	*	8.21	absent
405	Jack's Reef CN	medial	HC	*	*	4.9	*	*	*	*	8.83	absent
407	Jack's Reef CN	proximal	UM	*	*	4.66	*	*	13.17	18.98	7.88	absent
22	Raccoon Notched	complete	l/u	38.84	20.64	5.29	31.87	20.64	12.34	*	6.97	absent
49	Raccoon Notched	proximal	HC	*	*	3.96	*	*	*	*	*	absent

ID#	Point Type	Position	Source	ml	mw	mt	bl	sw	nw	bw	sl	dc
135	Raccoon Notched	complete	UM	35.51	*	5.76	29.87	*	*	*	5.64	absent
159	Raccoon Notched	proximal	HC	*	*	*	*	*	*	*	*	absent
241	Raccoon Notched	proximal	l/u	*	23.83	4.64	*	*	11.77	*	7.81	absent
256	Raccoon Notched	proximal	l/u	*	*	*	*	*	*	*	*	absent
260	Raccoon Notched	proximal	UM	*	*	4.05	*	23.56	13.82	19.2	6.9	absent
261	Raccoon Notched	proximal	UM	*	*	5.08	*	23.78	13.71	*	*	absent
11	Levanna Triangular	complete	l/u	30.75	27.54	4	30.75	n/a	n/a	27.54	n/a	1.43
64	Levanna Triangular	complete	l/u	28.32	20.03	3.67	28.32	n/a	n/a	20.03	n/a	0.81
87	Levanna Triangular	proximal	l/u	*	24.61	4.76	*	n/a	n/a	24.61	n/a	1.67
103	Levanna Triangular	proximal	l/u	*	23.42	5.08	*	n/a	n/a	23.42	n/a	0.82
168	Levanna Triangular	proximal	l/u	*	25.4	4.86	*	n/a	n/a	25.4	n/a	1.4
230	Levanna Triangular	complete	l/u	22.11	19.49	3.77	22.11	n/a	n/a	19.49	n/a	0.99
8	Madison Triangular	proximal	l/u	27.32	17.09	3.57	27.32	n/a	n/a	17.09	n/a	absent
57	Madison Triangular	complete	l/u	27.86	*	3.97	27.86	n/a	n/a	*	n/a	absent

ID#	Point Type	Position	Source	ml	mw	mt	bl	sw	nw	bw	sl	dc
154	Madison Triangular	medial	l/u	*	*	3.79	*	n/a	n/a	14.79	n/a	absent
196	Madison Triangular	proximal	l/u	*	24.27	4.34	*	n/a	n/a	21.71	n/a	0.73
252	Madison Triangular	proximal	l/u	*	*	4.26	*	n/a	n/a	19.94	n/a	absent
264	Madison Triangular	proximal	l/u	*	21.11	5.9	*	n/a	n/a	21.11	n/a	1.04

Appendix A: Projectile Points

Table A2: Projectile Point Locations, Descriptive Attributes, and Weights (in grams)

Unit	ID#	Point Type	Position	#Breaks	Breakage	Description/Break Location	Heated	Cortex	Source	wt(g)
N/A	5	Jack's Reef CN	P	2	snap	1 trans blade 1 lateral stem snaps	no	<10%	l/u	3.43
S5E100	82	Jack's Reef CN	P	1	snap	1 trans blade snap	no	no	l/u	2.32
S5E105	89	Jack's Reef CN	P	1	snap	1 trans blade snap 1 shoulder chipped	no	no	HC	2.21
S10E115	123	Jack's Reef CN	P	1	snap	trans blade snap	no	no	HC	3.94
S10E120	134	Jack's Reef CN	P	1	impact	trans blade irregular break	no	no	HC	4.04
N/A	194	Jack's Reef CN	P	2	snap	1 trans blade 1 retouched diag sh&ba snap	no	no	l/u	2.36

Unit	ID#	Point Type	Position	#Breaks	Breakage	Description/Break Location	Heated	Cortex	Source	wt(g)
N5E110	176	Jack's Reef CN	P	4	snap	P/M/D 1 trans tip 1 lat sh 2 lat base snaps	no	no	UM	3.96
N/A	206	Jack's Reef CN	M	2	snap	1 tip 1 neck snap	no	no	l/u	2.53
N/A	254	Jack's Reef CN	P	2	snap	1 trans blade 1 diag base snaps	no	no	UM	0.72
N/A	405	Jack's Reef CN	M	2	fc; snap	1 fc lat blade & stem 1 trans blade snap	yes	no	HC	4.07
N/A	407	Jack's Reef CN (blunt)	P	1	snap	1 polished trans blade; shoulder chipped	no	no	UM	2.07
S10E90	22	Raccoon Notched	C	0	n/a	1 stem corner chipped	no	no	l/u	4.11
N/A	49	Raccoon Notched	P	3	snap	1 trans blade 1 diag stem 1 diag sh/neck snaps	no	no	HC	1.01
S10E120	135	Raccoon Notched	C	1	snap	nearly C 1 lat sh/stem pressure snap at notch work	no	no	UM	4.14
N/A	159	Raccoon Notched	P	2	fc	1 trans stem 1 diag snaps potlidded	yes	no	HC	0.32
N5E190	241	Raccoon Notched	P	2	snap	1 trans blade 1 diag snaps	no	no	l/u	2.1
S5E195	256	Raccoon Notched	P	2	snap	1 trans neck/stem 1 trans base snaps	no	no	l/u	0.5

Unit	ID#	Point Type	Position	#Breaks	Breakage	Description/Break Location	Heated	Cortex	Source	wt(g)
N/A	260	Raccoon Notched	P	1	snap	1 diag tip snap secondary notching	no	no	UM	3.52
N/A	261	Raccoon Notched	P	2	snap	1 diag blade polished rework 1 diag base snaps	no	no	UM	2.24
N/A	11	Levanna Triangular	C	0	n/a	triangular	no	no	l/u	2.74
S5E135	64	Levanna Triangular	C	0	n/a	non descript	no	<10%	l/u	1.7
S10E105	87	Levanna Triangular	P	1	snap	P/M base frag trans snap	no	no	l/u	1.58
S10E110	103	Levanna Triangular	P	1	snap	P/M base frag trans snap	no	no	l/u	2.09
N/A	168	Levanna Triangular	P	1	snap	P/M base frag trans snap fire reddened	no	no	l/u	2.84
N/A	230	Levanna Triangular	C	0	n/a	comparatively small in size	no	no	l/u	1.47
N/A	8	Madison Triangular	C	0	n/a	unif triangular	no	no	l/u	1.41
N/A	57	Madison Triangular	M	1	snap	diag corner snap	no	no	l/u	1.99
N/A	154	Madison Triangular	P	1	snap	P/M base frag trans snap	no	no	l/u	0.84
N10E140	196	Madison Triangular	P	1	snap	P/M base frag trans snap	no	no	l/u	3.11

Unit	ID#	Point Type	Position	#Breaks	Breakage	Description/Break Location	Heated	Cortex	Source	wt(g)
N/A	252	Madison Triangular	P	1	snap	1 trans snap	no	no	l/u	2.04
N/A	264	Madison Triangular	P	1	snap	P/M/D tip snapped 33.73 min length	no	no	l/u	3.75

Table A3: Raw Material Significance Test for Projectile Points

Observed frequencies:

	Exotic	Local	Total
Jack's Reef and Raccoon Notched	12	7	19
Levanna and Madison	0	12	12
Total	12	19	31

Test of independence between the rows and the columns

(Chi-square with Yates' continuity correction):

Chi-square (Observed value)	9.847
Chi-square (Critical value)	3.841
DF	1
p-value	0.002
alpha	0.05

statistically significant at.02

Table A4: Statistical Analysis for Maximum Thickness on Projectile Points

Source/Point Type	Median	Mean	Std. Dev.	Variance	Skewness	Kurtosis
exotic notched (n=11)	4.35	4.57	0.55	0.30	0.99	0.65
local/unidentified triangular (n=12)	4.13	4.33	0.70	0.49	1.08	0.77

Appendix B: Formal Tools

Table B1: Formal Tool Locations, Break Patterns, Descriptions, Metrics (in millimeters), and Weights (in grams)   *no data

Unit	ID#	Type	Position	#Breaks	Breakage	Description/Break Locations	Heat	Cortex	Source	mw	ml	mt	wt(g)
N/A	150	burin	C	0	n/a	triangular	no	no	l/u	17.86	27.93	7.67	2.7
N10E135	200	burin	C	0	n/a	ovate	no	no	l/u	28.15	34.18	9.74	6.62
N/A	352	chisel	P	1	snap	1 trans fire reddened proximal reworked point?	yes	no	HC	17.58	*	3.79	1.38
TEST 3	523	tri-drill	P	1	snap	© 32.78 min length trans tip snap	no	no	l/u	20.64	*	5.19	2.47
N/A	418	cn drill	D	1	snap	© 41.3 min length lat base snap	no	no	l/u	22.73	*	5.07	2.65
N/A	167	cn drill	D	1	snap	© 34.52 min length lat base snap	no	no	UM	*	*	4.77	1.62
S20E150	34	T-drill	M	2	snap	1 trans tip 1 diag base snaps	no	no	l/u	18.71	*	4.54	1.16
S20E150	35	T-drill	P	2	fc	basal frag 2 diag snaps potlidded	yes	no	HC	*	*	3.73	0.57

Unit	ID#	Type	Position	#Breaks	Breakage	Description/Break Locations	Heat	Cortex	Source	mw	ml	mt	wt(g)
S5E140	61	T-drill	C	0	n/a	complete "T" shaped	no	no	l/u	15.71	28.57	5.18	1.5
N5E140	235	T-drill	P	1	snap	trans tip snap	no	no	UM	21.89	*	4.54	1.35
N/A	344	T-drill	M	4	snap	1 trans tip 1 lat base 2 diag base snaps	no	no	HC	*	*	8.34	4.06
N/A	403	other drill (triangular)	C	0	n/a	triangular w/chipped corner unif concave base	no	no	UM	11.96	44.47	6	2.85
N/A	406	drill tip/medial frag	M	2	snap	medial frag 2 diag snaps potlidded	yes	no	HC	*	*	5.85	1.13
S5E115	119	drill tip/medial frag	D	1	snap	tip frag diag snap	no	no	l/u	*	*	5.96	1.43
N5E135	227	drill tip/medial frag	D	1	snap	tip frag diag snap	no	no	UM	*	*	4.2	0.35
N/A	244	drill tip/medial frag	D	1	fc	tip frag diag snap potlidded	yes	no	HC	*	*	3.42	0.24
N/A	265	scraper	D	1	snap	end frag	no	no	l/u	31.27	*	13.07	6.9
N/A	272	scraper	C	0	n/a	ovate; unif	no	no	HC	41.67	52.3	10.27	19.28
N/A	173	scraper	C	0	n/a	ovate/elongated; unif at 1 end	no	no	HC	31.21	65.82	11.35	20.66
N/A	424	scraper	C	0	n/a	blocky base 7.33 min length t at P end	no	no	l/u	26.1	38.43	16.36	10.82
N/A	149	scraper	D	1	impact	ovate/elongated; PB inside trans break	no	no	l/u	38.27	*	15.36	25.96
S5E95	25	scraper	C	0	n/a	ovate/elongated	no	no	l/u	38.36	66.87	16.89	51.79
S30E150	42	scraper	D	2	snap	1 coronal & 1 transverse breaks	no	no	HC	21.22	*	*	1.22
N5E135	no #	point/knife tip/edge	D	1	impact	non diagnostic; concave tip shatter	no	no	UM	*	*	*	0.23

Unit	ID#	Type	Position	#Breaks	Breakage	Description/Break Locations	Heat	Cortex	Source	mw	ml	mt	wt(g)
S15E120	no #	point/knife tip/edge	M	3	snap	non diagnostic shatter	no	no	HC	*	*	*	0.63
S15E150	29	point/knife tip/edge	P	1	snap	non diagnostic tri base trans snap	no	no	l/u	*	*	*	2.2
S10E135	75	point/knife tip/edge	P	1	snap	non diag tri base diagonal snap	no	no	l/u	*	23.15	3.76	1.09
S5E130	79	point/knife tip/edge	D	1	snap	non diagnostic trans snap	no	no	UM	*	*	4.55	1.83
N/A	146	point/knife tip/edge	?	1	snap	non diagnostic loc indete shatter	no	no	HC	*	*	*	0.33
N/A	153	point/knife tip/edge	M	2	snap	non diagnostic 2 trans stem breaks	no	no	UM	*	*	4.97	2.79
N/A	166	point/knife tip/edge	D	1	snap	non diagnostic trans snap	no	no	HC	*	*	4.81	1.82
S10E115	174	point/knife tip/edge	M	1	snap	non diag diagonal snap	no	no	l/u	*	27.31	5.19	2.16
N5E120	180	point/knife tip/edge	?	2	snap	non diagnostic jagged fire cracked	yes	no	UM	*	*	*	0.93
N5E110	181	point/knife tip/edge	P	1	snap	non diag trans snap corner removed	no	no	l/u	*	*	6.39	2.67
N5E140	236	point/knife tip/edge	D	1	snap	non diagnostic trans snap	no	no	l/u	*	*	*	0.46
N5E190	238	point/knife tip/edge	P	1	snap	non diag lat snap ea corner removal	no	no	UM	*	*	*	0.27
N/A	231	point/knife tip/edge	D	1	snap	non diag transverse snap	no	no	UM	*	*	5.36	4.01
N/A	242	point/knife tip/edge	D	1	snap	non diag transverse snap	no	no	UM	*	*	6.5	2.84
S5E195	255	point/knife tip/edge	D	1	snap	non diagnostic tip frag trans snap	no	no	UM	*	*	*	0.42
S5E195	257	point/knife tip/edge	?	1	impact	non diag loc indeter fire cracked	yes	no	HC	*	*	*	0.93

Unit	ID#	Type	Position	#Breaks	Breakage	Description/Break Locations	Heat	Cortex	Source	mw	ml	mt	wt(g)
S5E160	259	point/knife tip/edge	P	2	snap	non diagnostic 1 trans 1 lat snaps	no	no	l/u	*	*	*	1.33
N/A	263	point/knife tip/edge	M	1	snap	non diag oval bf; crescent shaped lat snap	no	no	HC	*	*	*	1.12
N/A	379	point/knife tip/edge	D	1	snap	non diag frag diagonal snap	no	no	UM	*	*	3.88	2.67
N/A	401	point/knife tip/edge	M	1	snap	non diag tip msg lateral snap	no	no	l/u	*	*	4.65	2.41
N/A	416	point/knife tip/edge	D	2	snap	non diag 1 lat 1 diagonal snaps	no	no	UM	*	*	4.22	3.6
N/A	419	point/knife tip/edge	D	1	snap	non diagnostic 1 transverse snap	no	no	l/u	*	*	5.64	2.28

Appendix C: Cores and Preforms

Table C1: Core Locations, Descriptive Attributes, Metrics (in millimeters), and Weights (in grams)

Unit	ID#	Type	Reduction	Heat	Cortex	Source	mw	ml	mt	wt(g)	Description
S5E75	1	core	multidirectional	no	yes	Upper Mercer	34.56	59.25	24.98	29.79	triangular w/lateral margin
N/A	2	core	multidirectional	no	yes	local/unidentified	39.72	69.05	20.65	67	lg flake removed from 1/2 core length
S5E90	15	core	multidirectional	no	<10%	local/unidentified	31.54	37.46	14.8	19.64	non descript
S5E145	38	core	multidirectional	no	yes	local/unidentified	41.08	49.52	34.43	52.37	non descript
S10E135	74	core tool	multidirectional	no	yes	local/unidentified	35.68	44.26	21.95	44.05	3 sides smooth; 1side broken; heavy batter

Unit	ID#	Type	Reduction	Heat	Cortex	Source	mw	ml	mt	wt(g)	Description
N/A	152	core	multidirectional	no	<10%	local/unidentified	40.26	43.62	17.61	23.56	rotated
S5E195	258	core	multidirectional	no	<10%	local/unidentified	no data	56.81	11.5	8.7	crescent shaped w/matched shattered edge
N/A	408	core	multidirectional	no	yes	local/unidentified	31.99	38.11	9.2	10.89	exhausted
TEST 3	525	core	unidirectional	no	no	Harrison County	27.89	42.75	11.53	8.27	2 lg flakes removed at lat margin; 1 PSR
N5E190	9001	core	unidirectional	no	yes	Harrison County	26.73	39.01	12.95	10.8	exhausted
N5E190	9002	core	multidirectional	no	yes	Upper Mercer	16.8	29.86	9.88	3.4	exhausted
N5E190	9003	core	multidirectional	no	<10%	Upper Mercer	19.24	25.61	15	4.21	exhausted; angular
N5E135	9005	core	multidirectional	no	no	local/unidentified	13.3	18.75	9.94	1.78	exhausted; angular
N10E195	9006	core	multidirectional	no	yes	local/unidentified	36.54	62.59	14.8	33.15	good opposing platforms
N10E130	9007	core	multidirectional	no	yes	Harrison County	31.54	32.75	14.23	10.4	detached core; rotated; + & - PSRs
N5E115	9008	core	multidirectional	no	yes	Upper Mercer	29.7	63.67	15.49	28.3	angular shatter breaks
S5E140	9009	core tool	multidirectional	no	no	Harrison County	12.51	21.69	7.49	1.28	exhausted; 1 edge utilized
S15E145	9010	core	unidirectional	no	100%	local/unidentified	27.67	36.35	13.62	11.39	cortical
S10E195	9011	core	multidirectional	no	no	local/unidentified	40.55	51.75	21.65	41.84	nondescript
S10E135	9012	core	multidirectional	no	yes	local/unidentified	29.26	36.26	15.22	18.25	nondescript
S10E135	9013	core	multidirectional	no	yes	local/unidentified	30.4	29.05	14.19	11.86	1 PSR
N5E140	9014	core tool	multidirectional	no	no	local/unidentified	22.11	22.48	7.92	3.95	exhausted; rotated; angular 1 edge utilized
N10E145	9015	core	multidirectional	no	<10%	local/unidentified	22.44	47.32	13.36	10.18	irregular shape

Unit	ID#	Type	Reduction	Heat	Cortex	Source	mw	ml	mt	wt(g)	Description
N10E130	9017	core	unidirectional	yes	100%	Upper Mercer	24.36	40.32	14.22	12.9	cortical
N5E195	9018	core	multidirectional	yes	yes	Upper Mercer	19.48	45.23	21.05	16.13	fire cracked
S5E145	9019	core	unidirectional	no	no	local/unidentified	25.43	40.97	8.66	7.53	unif flake w/single ventral flake removed; 1 PSR
N10E155	9020	core	unidirectional	no	<10%	local/unidentified	12.95	24.38	7.38	1.9	exhausted
N15E145	9021	core	unidirectional	no	no	local/unidentified	24.86	42.95	9.82	12.08	detached core
N10E155	9023	core	multidirectional	no	yes	local/unidentified	20.6	25.44	13.83	4.73	angular; sharp grooves (abrader?)
S10E155	9024	core	multidirectional	no	no	local/unidentified	15.9	20.04	7.17	3.09	exhausted; broken
S10E140	9025	core	unidirectional	no	no	Harrison County	24.84	46.84	14.43	11.19	exhausted; 4 lg flakes removed
S15E120	9026	core	multidirectional	no	yes	local/unidentified	30.44	42.47	16.48	21.53	rotated
S5E140	9027	core	multidirectional	no	no	local/unidentified	28.02	33.81	17.32	16.01	nondescript
S10E130	9028	core	unidirectional	no	yes	Harrison County	27.78	34.24	8.83	6.96	detached core; primary flake; broken; 2 PSR
S5E125	9029	core	multidirectional	no	<10%	Harrison County	22.23	44.35	9.63	10.48	exhausted; broken
SURFACE	9030	core	multidirectional	no	yes	Harrison County	47.4	49.25	16.07	25.13	non descript
SURFACE	9031	core	unidirectional	no	<10%	Harrison County	29.16	42.9	11.16	11.85	non descript
SURFACE	9032	core	unidirectional	no	yes	Harrison County	24.35	37.18	11.42	8.68	non descript
SURFACE	9033	core	multidirectional	no	yes	Harrison County	19.78	38.97	13.9	14.95	non descript
SURFACE	9034	core	unidirectional	no	yes	Harrison County	26.21	33.85	18.02	8.56	non descript
SURFACE	9039	core	multidirectional	no	yes	local/unidentified	17.54	23.03	11.03	3.12	non descript
SURFACE	9040	core	multidirectional	no	yes	local/unidentified	45.54	53.24	20.83	40.83	non descript

Unit	ID#	Type	Reduction	Heat	Cortex	Source	mw	ml	mt	wt(g)	Description
SURFACE	9041	core	multidirectional	no	yes	local/unidentified	34.26	54.08	19.95	41.15	non descript
SURFACE	9042	core	unidirectional	no	yes	local/unidentified	40.18	56.75	18.03	56.84	single lg flake removed; 1 PSR
SURFACE	9043	core	multidirectional	no	yes	local/unidentified	47.24	53.48	16.33	37.03	non descript
SURFACE	9044	core	unidirectional	no	yes	local/unidentified	23.25	35.73	9.95	6.36	detached core flake
SURFACE	9045	core	unidirectional	no	yes	Upper Mercer	17.34	32.23	16.45	7.2	shatter
SURFACE	9046	core	unidirectional	no	yes	local/unidentified	24.07	44.88	19.81	16.8	non descript
SURFACE	9047	core	multidirectional	no	100%	local/unidentified	35.05	46.31	22.58	42.47	cortical
SURFACE	9048	core	unidirectional	no	yes	local/unidentified	36.44	58.3	20.92	44.74	non descript
SURFACE	9049	core	unidirectional	no	yes	local/unidentified	39.23	44.72	17.4	23.88	non descript
SURFACE	9050	core	multidirectional	no	yes	local/unidentified	35.8	47.33	22.95	33.57	non descript
SURFACE	9051	core	unidirectional	no	yes	local/unidentified	37.35	54.8	24.84	42.29	non descript
SURFACE	9052	core	unidirectional	no	yes	local/unidentified	29.93	32.42	16.79	15.25	non descript
SURFACE	9053	core	unidirectional	no	yes	local/unidentified	27.17	28	12.95	8.43	non descript
SURFACE	9054	core	unidirectional	no	yes	local/unidentified	22.93	30.19	18.45	14.5	non descript
SURFACE	9055	core	multidirectional	no	yes	local/unidentified	29.73	38.53	14.54	15.26	non descript
SURFACE	9056	core	multidirectional	no	yes	Upper Mercer	25.76	34.87	12.29	12.27	non descript
SURFACE	9057	core	multidirectional	no	yes	local/unidentified	19.66	23.19	8.58	3.04	non descript
SURFACE	9058	core	unidirectional	yes	<10%	Upper Mercer	20.06	36.99	12.34	6.44	exhausted; firecracked & potlidded
SURFACE	9059	core	unidirectional	no	<10%	local/unidentified	22.24	36.31	7.39	6.77	detached core flake
SURFACE	9060	core	multidirectional	no	yes	local/unidentified	19.65	31.21	11.16	7.55	rotated
SURFACE	9061	core	multidirectional	no	<10%	local/unidentified	20.32	40.08	18.38	11.5	non descript
SURFACE	9062	core	unidirectional	no	no	local/unidentified	24.32	27.05	14.81	7.56	broken at impurity

Unit	ID#	Type	Reduction	Heat	Cortex	Source	mw	ml	mt	wt(g)	Description
SURFACE	9063	core	multidirectional	no	<10%	local/unidentified	23.93	35.44	8.46	6.5	exhausted
SURFACE	9064	core	multidirectional	no	yes	local/unidentified	27.21	33.98	13.34	8.74	non descript
SURFACE	9065	core	multidirectional	no	yes	local/unidentified	24.52	32.19	11.39	7.46	non descript
SURFACE	9066	core	multidirectional	no	<10%	Upper Mercer	23.71	27.26	11.23	6.25	non descript
N5E195	9068	core	multidirectional	yes	yes	Upper Mercer	22.42	29.44	13.94	8.56	fire cracked
S10E130	9069	core	multidirectional	no	no	Harrison County	15.28	27.47	6.95	2.08	shatter

Table C2: Preform Locations, Descriptive Attributes, and Weights (in grams) *no data

Unit	ID#	Type	Stage	Type	#Breaks	Descriptions/Break Patterns	Heat	Cortex	Source	mw (mm)	ml (mm)	mt (mm)	wt(g)
S15E145	31	PREFORM	middle	bf	multiple	fragment	no	no	HC	*	*	*	2.36
N/A	33	PREFORM	late	bf	n/a	complete pentagonal	no	no	HC	33.75	76.56	5.41	16.26
N/A	58	PREFORM	late	bf	1	end frag transverse snap	no	yes	HC	*	*	*	5.42
S15E140	60	PREFORM	middle	bf	1	pentagonal lateral snap	no	yes	l/u	*	59.53	10.59	8.46
N/A	101	PREFORM	middle	bf	1	end frag transverse snap	no	no	l/u	*	*	*	3.2
S10E110	104	PREFORM	late	bf	1	end frag transverse snap; 1side CN	no	no	l/u	*	*	4.5	1.69
S15E120	114	PREFORM	middle	bf	1	end frag transverse snap	no	no	HC	*	*	7.38	3.91
S5E115	117	PREFORM	middle	bf	1	end frag pentagonal transverse snap	no	yes	HC	40.85	*	9.25	14.08
S5E115	118	PREFORM	early	bf	n/a	early preform	no	yes	l/u	39.11	42.91	13.11	22.11
S5E120	125	PREFORM	middle	bf	2	medial frag 2 trans snaps potlidded	yes	no	HC	*	*	7.54	7.03

Unit	ID#	Type	Stage	Type	#Breaks	Descriptions/Break Patterns	Heat	Cortex	Source	mw (mm)	ml (mm)	mt (mm)	wt(g)
N/A	151	PREFORM	early	bf	n/a	early preform	no	<10%	l/u	23.75	33.55	10.5	8.47
N/A	156	PREFORM	middle	bf	3	1 trans 1 lat 1 end snaps	no	no	UM	*	*	6.43	2.02
N15E110	175	PREFORM	late	bf	n/a	complete pentagonal	no	no	l/u	25.08	38.48	4.07	4.1
N10E125	177	PREFORM	late	bf	2	chipped tip 2 lateral base snaps	no	yes	l/u	31.31	41.13	6.43	7.08
N10E130	197	PREFORM	late	bf	1	PSR at trans snap; refits to 234	no	no	l/u	26.18	*	7.66	5.24
N5E125	202	PREFORM	middle	unif	n/a	complete flake w/worked edges	no	yes	HC	17.26	36.81	5.35	3.66
N5E130	213	PREFORM	middle	bf	1	end frag 1 lateral fire cracked snap	yes	no	HC	*	*	7.97	3.57
N5E140	234	PREFORM	late	bf	1	pentagonal trans snap; refits to 197	no	no	l/u	20.55	*	5.97	2.5
S20E170	240	PREFORM	late	bf	1	end frag transverse snap	no	no	UM	*	*	6.35	4.22
N/A	253	PREFORM	late	bf	1	triangular base trans snap	no	no	l/u	27.95	*	6.75	5.47
N/A	267	PREFORM	middle	bf	2	end frag 1 fc lat 1 fc trans snaps	yes	no	HC	*	*	*	3.63
N/A	404	PREFORM	middle	bf	1	end frag transverse snap	no	no	UM	*	*	9.81	6.07
N/A	409	PREFORM	middle	bf	1	triangular frag transverse snap	no	yes	HC	*	*	8.86	5.67
N/A	412	PREFORM	late	bf	n/a	complete irregular pentagonal	no	no	UM	19.3	40.37	5.91	3.9
N5E130	8998	PREFORM	middle	bf	multiple	shattered frag	no	no	UM	*	*	*	0.96
S10E135	8999	PREFORM	middle	bf	multiple	fragment	no	no	UM	*	*	*	0.79
S10E125	9004	PREFORM	middle	bf	multiple	broken preform; impurity snaps	no	no	HC	19.95	*	5.89	3.35

Unit	ID#	Type	Stage	Type	#Breaks	Descriptions/Break Patterns	Heat	Cortex	Source	mw (mm)	ml (mm)	mt (mm)	wt(g)
S5E130	9016	PREFORM	early	unif	n/a	complete flake w/PSR and edge work	no	<10%	l/u	35.65	37.16	10.62	16.12
S5E120	9022	PREFORM	middle	bf	multiple	broken/shattered	no	no	HC	13.56	*	5.22	1.11
TEST 3	524	PREFORM	late	bf	1	base transverse snap early notching	no	no	l/u	*	*	5.17	2.37
TEST 3	526	PREFORM	middle	unif	1	flake 1 concave snap	no	no	HC	*	*	4.65	3.9
SURFACE	9035	PREFORM	early	unif	2	unif frag 2 breaks	no	no	HC	*	*	*	1.52
SURFACE	9036	PREFORM	middle	bf	multiple	shattered	no	yes	HC	*	*	*	1.7
SURFACE	9037	PREFORM	middle	bf	1	tip fragment 1 trans snap/material impurity	no	<10%	HC	*	*	*	3.65
SURFACE	9038	PREFORM	middle	bf	3	corner frag 3 snaps; worked edges at snaps	no	no	HC	*	*	6.61	2.6
SURFACE	9067	PREFORM	middle	bf	n/a	complete triangular	no	yes	l/u	33.46	31.26	10.12	8.12

Table C3: Significance Test for Cores and Preforms

Observed frequencies:

	A	B	Total
Cores	1	9	10
Preforms	4	4	8
Total	5	13	18

Test of independence between the rows and the columns

(Chi-square with Yates' continuity correction):

Chi-square (Observed value)	1.831
Chi-square (Critical value)	3.841
DF	1
p-value	0.176
alpha	0.05

statistical significance at .176

Appendix D: Area A and Area B Analyses

Table D1: Area A Informal Tool Metrics, Descriptive Attributes, and Weights (in grams)

Area	Unit	Position	Size(cm)	Heat	Cortex	Source	wt(g)
A	N5E120	C	1-2	no	no	l/u	0.37
A	N5E120	C	1-2	no	no	l/u	0.34
A	S10E120	C	1-2	yes	no	HC	0.43
A	N5E110	C	1-2	no	no	HC	0.15
A	N5E110	C	2-3	no	no	l/u	0.59
A	N5E115	C	2-3	no	yes	HC	1.93
A	N5E115	C	2-3	no	no	HC	0.89
A	S5E115	C	2-3	no	no	HC	1.41
A	S5E120	C	2-3	no	yes	HC	2.71
A	S10E120	C	2-3	no	yes	HC	1.84
A	S10E120	C	2-3	no	no	HC	0.64
A	N5E110	C	2-3	no	yes	HC	0.85
A	N5E110	C	3-4	no	no	l/u	5.02
A	N5E120	C	3-4	no	no	UM	1.18
A	S5E115	C	3-4	no	no	HC	1.44
A	S5E115	C	3-4	no	no	HC	1.41
A	S5E120	C	3-4	no	no	HC	1.65
A	N5E110	C	3-4	no	no	HC	0.8

Area	Unit	Position	Size(cm)	Heat	Cortex	Source	wt(g)
A	S5E115	C	4-5	no	no	HC	4.42
A	N5E120	D	1-2	no	no	HC	0.16
A	S10E120	D	1-2	no	no	UM	0.42
A	S10E120	D	1-2	no	yes	l/u	0.5
A	S10E120	D	1-2	no	no	HC	0.51
A	N5E115	M	1-2	no	no	HC	0.23
A	S10E120	M	1-2	no	no	HC	0.88
A	N5E110	M	1-2	no	no	HC	0.52
A	S10E120	M	2-3	no	no	HC	1.61
A	N5E110	P	1-2	no	no	l/u	1.03
A	S10E120	P	1-2	no	yes	UM	1.08
A	S10E120	P	1-2	no	no	UM	1.04
A	S10E120	P	2-3	no	no	HC	1.03
A	S10E120	P	2-3	no	no	HC	0.9

Table D2: Area B Informal Tool Metrics, Descriptive Attributes, and Weights (in grams)

Area	Unit	Position	Size(cm)	Heat	Cortex	Source	wt(g)
B	N5E130	C	1-2	no	no	l/u	0.52
B	S5E145	C	1-2	no	no	UM	0.37
B	S5E145	C	1-2	no	no	l/u	0.4
B	S5E140	C	1-2	no	no	l/u	0.56
B	N5E140	C	1-2	no	no	l/u	0.46
B	N5E135	C	1-2	no	no	HC	0.43
B	N5E135	C	1-2	no	no	UM	0.44
B	N5E130	C	1-2	no	no	HC	0.24
B	N5E130	C	1-2	no	no	HC	0.65
B	N5E130	C	1-2	no	no	HC	0.29
B	N5E130	C	1-2	yes	no	HC	0.24
B	N5E130	C	1-2	yes	no	HC	0.21

Area	Unit	Position	Size(cm)	Heat	Cortex	Source	wt(g)
B	N5E130	C	1-2	no	no	HC	0.29
B	S5E145	C	2-3	no	no	UM	2.08
B	S10E135	C	2-3	no	<10%	HC	0.53
B	N5E140	C	2-3	no	yes	l/u	0.88
B	N5E140	C	2-3	no	no	l/u	0.4
B	S5E135	C	2-3	no	<10%	l/u	0.85
B	S5E135	C	2-3	no	<10%	l/u	1.85
B	N5E135	C	2-3	no	yes	HC	1.37
B	N5E135	C	2-3	no	yes	HC	1.22
B	N5E135	C	2-3	no	yes	HC	1.73
B	N5E135	C	2-3	no	no	UM	0.58
B	S5E135	C	2-3	no	no	l/u	1.84
B	N5E130	C	2-3	no	no	HC	0.79
B	N5E130	C	2-3	yes	no	HC	0.7
B	N5E130	C	2-3	no	no	HC	0.91
B	N5E130	C	2-3	no	no	UM	0.92
B	N5E130	C	2-3	no	no	HC	1.14
B	N5E140	C	2-3	no	no	l/u	2.18
B	N5E130	C	3-4	no	yes	HC	1.57
B	S10E135	C	3-4	no	no	HC	2.04
B	S10E135	C	3-4	yes	no	HC	1.21
B	N5E140	C	3-4	no	no	UM	5.92
B	S5E135	C	3-4	no	yes	l/u	4.45
B	S5E135	C	3-4	no	yes	l/u	1.98
B	S5E140	C	3-4	no	no	HC	1.17
B	S5E135	C	3-4	no	no	HC	3.25
B	S5E135	C	3-4	no	no	HC	1.81
B	S5E135	C	3-4	yes	no	HC	2.51
B	N5E130	C	3-4	no	no	HC	2.21
B	N5E130	C	3-4	no	no	HC	3.19

Area	Unit	Position	Size(cm)	Heat	Cortex	Source	wt(g)
B	S5E140	D	1-2	yes	no	HC	0.35
B	S10E135	D	1-2	no	no	HC	0.69
B	S5E135	D	1-2	no	no	HC	0.29
B	N5E130	D	1-2	no	no	HC	1.31
B	N5E130	D	2-3	yes	no	UM	1.67
B	S5E140	D	2-3	no	no	HC	0.7
B	N5E135	D	2-3	no	no	HC	0.6
B	S5E135	D	2-3	no	no	HC	0.65
B	S10E135	D	2-3	no	no	HC	0.69
B	S10E135	D	2-3	no	no	HC	1.51
B	N5E130	D	2-3	yes	no	UM	2.4
B	N5E135	M	1-2	no	no	UM	0.61
B	N5E135	M	1-2	no	no	HC	0.77
B	S5E140	M	1-2	no	no	HC	0.28
B	N5E130	M	1-2	no	yes	l/u	0.47
B	N5E130	M	1-2	yes	no	HC	0.35
B	S10E135	M	2-3	no	no	HC	1.55
B	N5E140	M	2-3	no	no	l/u	1.26
B	S5E145	M	2-3	no	yes	HC	0.98
B	S5E140	M	2-3	no	no	HC	1.11
B	S5E135	P	1-2	no	no	UM	0.68
B	N5E135	P	1-2	no	no	HC	0.58
B	N5E130	P	2-3	no	no	UM	0.72
B	S5E145	P	2-3	no	no	UM	1.61
B	S5E140	P	2-3	no	no	l/u	0.3
B	N5E135	P	2-3	no	no	UM	0.52
B	N5E135	P	2-3	no	yes	l/u	2.98
B	S5E140	P	2-3	no	yes	l/u	1.09
B	S5E135	P	2-3	no	no	UM	1.66

Table D3: Area A and B Debitage Source Frequencies by Size Class

Area A	Size Class				
	<1 cm (n=168) 31%	1-2 cm (n=293) 54%	2-3 cm (n=67) 12%	3-4 cm (n=12) 2%	4-5 cm (n=1) <1%
Harrison County (n=235) 43%	63	132	35	4	1
percent of source	27%	56%	15%	2%	<1%
percent of class total	38%	45%	52%	33%	<1%
Upper Mercer (n=30) 6%	8	16	5	1	0
percent of source	27%	53%	17%	3%	
percent of class total	5%	6%	8%	8%	
local/unidentified (n=276) 51%	97	145	27	7	0
percent of source	35%	53%	10%	2%	
percent of class total	57%	49%	40%	59%	

Area B	Size Class				
	<1 cm (n=354) 32%	1-2 cm (n=635) 58%	2-3 cm (n=92) 8%	3-4 cm (n=17) 2%	4-5 cm (n=1) <1%
Harrison County (n=331) 30%	109	184	36	2	0
percent of source	33%	56%	11%	<1%	
percent of class total	31%	29%	40%	12%	
Upper Mercer (n=63) 6%	14	41	8	0	0
percent of source	22%	65%	13%		
percent of class total	4%	6%	8%		
local/unidentified (n=705) 64%	231	410	48	15	1
percent of source	33%	58%	7%	2%	<1%
percent of class total	65%	65%	52%	88%	<1%

Table D4: Area A and B Debitage by Flake Type

	Flake Type				
Area A	complete (n=140) 26%	proximal (n=102) 19%	medial (n=144) 27%	distal (n=91) 17%	shatter (n=64) 11%
Harrison County (n=235) 43%	61	53	51	41	29
percent of source	26%	23%	22%	17%	12%
percent of type total	44%	52%	36%	45%	45%
Upper Mercer (n=30) 6%	10	5	9	3	3
percent of source	33%	17%	30%	10%	10%
percent of type total	7%	5%	6%	3%	5%
local/unidentified (n=276) 51%	69	44	84	47	32
percent of source	25%	16%	30%	17%	12%
percent of type total	49%	43%	58%	52%	50%

Area B	complete (n=235) 21%	proximal (n=176) 16%	medial (n=428) 39%	distal (n=172) 16%	shatter (n=88) 8%
Harrison County (n=331) 30%	67	54	115	67	28
percent of source	20%	16%	35%	20%	9%
percent of type total	29%	31%	27%	39%	32%
Upper Mercer (n=63) 6%	21	9	21	8	4
percent of source	33%	14%	33%	13%	7%
percent of type total	9%	5%	5%	5%	4%
local/unidentified (n=705) 64%	147	113	292	97	56
percent of source	21%	16%	41%	14%	8%
percent of type total	62%	64%	68%	56%	64%

Database Legend

bf: bifacial
bl: blade length
bw: basal width
C: complete
D: distal
dc: depth of basal concavity
diag: diagonal
fc: firecracked
frag: fragment
g: grams
HC: Harrison County
l/u: local/unidentified
lat: lateral
M: medial
ml: maximum length
ml: maximum thickness
mw: maximum width
n/a: not applicable
nw: neck width
P: proximal
PSR: platform scar remnant
S: shatter
sh: shoulder
sl: stem length
sw: shoulder width
trans: transverse
UM: Upper Mercer
unif: unifacial
wt: weight